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Original Research Article

Influence of Food Hygiene Practices on Diarrheal Incidence Among Children of Working Mothers in Gazipur District, Bangladesh

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ABSTRACT: ***Background:*** Diarrheal diseases remain a leading cause of morbidity in children in rural Bangladesh, with poor hygiene practices, unsafe water, and low maternal education contributing to their prevalence. Ensuring proper food hygiene and access to clean water is crucial in reducing diarrhea in children, particularly among working mothers who may lack time for proper health practices. ***Objective:*** This study aimed to assess the impact of food hygiene practices, water sources, and maternal education on the frequency of diarrheal episodes in children of working mothers in rural Bangladesh. Methods: A cross-sectional study was conducted in the Gazipur district, collecting data from 260 working mothers with children aged 1-6 years. Data were gathered from four Upazila health complexes (Kaliakair, Kapasia, Sreepur, and Kaliganj) from January to August 2024. Information on demographics, food hygiene practices, water sources, and frequency of diarrheal episodes was collected using structured interviews and a pre-tested questionnaire. Statistical analysis was performed using chi-square tests, with a p-value <0.05 considered statistically significant. ***Results:*** The study found that 46.2% of children experienced more than 4 episodes of diarrhea in the last 3 months. Poor food hygiene practices, such as inconsistent handwashing (46.2%) and improper vegetable washing (53.8%), were associated with higher incidences of diarrheal episodes. Children who consumed well water had a significantly higher frequency of diarrheal episodes (38.5%) compared to those who drank boiled water (9.6%), with a p-value of <0.001. Maternal education was also linked to diarrheal risk, with children of mothers with no formal education experiencing 70% more severe episodes of diarrhea. ***Conclusion:*** The study highlights the critical role of hygiene practices, water quality, and maternal education in the prevalence of diarrheal episodes in rural Bangladesh. Interventions to improve hygiene, water safety, and education for mothers could significantly reduce the incidence of diarrheal diseases in children.

Keywords: Food Hygiene, Diarrhea Episodes, Maternal Education, Water Quality, Rural Bangladesh.

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INTRODUCTION

Diarrheal diseases among children under 5 years of age cause considerable morbidity and significantly contribute to child mortality in Bangladesh [1,2]. A substantial proportion of diarrheal episodes can be attributed to contaminated food, a widespread concern across both low- and high-income countries [3,4]. Hands that are not washed after fecal contact can serve as a direct source of diarrhea pathogens, and food can become contaminated through contact with unwashed hands5. Raw vegetables are especially vulnerable to contamination by pathogens [5,6]. Cross-contamination, which involves the transfer of pathogens from a contaminated food source (via hands or utensils) to uncontaminated food, is another key pathway for the transmission of

disease. When contaminated foods are not consumed immediately or are improperly stored without refrigeration, pathogenic bacteria can multiply, leading to further health risks [7-15]. In rural Bangladesh, children in households where caregivers washed at least one hand with soap during food preparation had significantly fewer days of diarrhea (3.7%) compared to children whose caregivers were observed not washing their hands at all during food preparation (12.5%), highlighting the critical role of handwashing in preventing diarrheal disease.16 However, handwashing during food preparation remains rare in rural areas of Bangladesh, with only 1% of food preparers observed washing their hands with soap during food preparation [16]. Similarly, in northeast Brazil, the majority of mothers demonstrated poor hand hygiene during food preparation, which contributed to the risk of introducing pathogens to foods [17].

The complexity of instructions, particularly for behaviors involving multiple steps like handwashing during food preparation, can hinder adherence to recommended hygiene practices [18-21]. Effective behavior change requires a thorough understanding of local conditions and drivers of hygiene practices. For instance, an intervention in India that incorporated local context significantly improved handwashing rates at key times, including during food preparation, from 1% at baseline to 37% at follow-up [22]. There is limited research, however, on food preparation steps and associated handwashing practices in low-income settings, where access to running water is often constrained [23-26]. Diarrheal diseases are a major public health concern in rural Bangladesh, particularly among children, where poor hygiene practices, contaminated water, and limited access to health services contribute to their high prevalence. According to the World Health Organization (WHO), diarrheal diseases are the second leading cause of death among children under five, with bacterial, viral, and parasitic infections being the primary contributors. In rural areas, where sanitation facilities are limited, the transmission of pathogens through unsafe food and water is a significant issue. Working mothers in these regions often face challenges in maintaining proper hygiene due to time constraints, lack of awareness, and limited resources. Studies have shown that poor maternal education and improper food hygiene practices, such as inadequate handwashing and improper food storage, increase the risk of diarrheal diseases in children. This study aims to explore the relationship between food hygiene practices, water quality, and maternal education in reducing diarrheal episodes among children in rural Bangladesh.

METHODOLOGY

The study utilized a cross-sectional design to assess the impact of food hygiene practices on diarrheal incidence among children of working mothers in rural Bangladesh. Conducted in the Gazipur District, data were collected from January to August 2024. The research focused on four Upazila health complexes—Kaliakair, Kapasia, Sreepur, Kaliganj—as well as Gazipur Sadar Hospital, targeting working mothers whose children had been diagnosed with diarrhea, either as indoor or outdoor patients. A structured questionnaire was used for data collection, designed to capture detailed information about the mothers' food hygiene practices. Key areas assessed included the preparation, storage, and handling of food, as well as the hygiene habits of both mothers and their household environments. The questionnaires were administered through face-to-face interviews, conducted by trained data collectors to ensure accurate and consistent data gathering.

The study participants were selected based on their willingness to participate and met the criteria of being working mothers with children affected by diarrhea during the study period. Informed consent was obtained from all participants prior to their inclusion in the study. Mothers were briefed about the purpose of the research, and assurances of confidentiality and voluntary participation were emphasized. The tools used in the data collection included a combination of closed-ended and open-ended questions, allowing for both quantitative and qualitative data analysis. Ethical approval was secured from the appropriate institutional review board, ensuring that the study adhered to the ethical principles outlined in the Declaration of

Helsinki, safeguarding the rights, privacy, and welfare of all participants.

RESULTS

Table 1: Age of Mothers and Children (N=260)

Variable	Frequency (n)	Percentage (%)
Age of Mother		
20-30 years	90	34.6
31-40 years	120	46.2
41-50 years	50	19.2
Child's Age (years)		
1-2 years	70	26.9
3-4 years	90	34.6
5-6 years	100	38.5

Table 1 presents the demographic characteristics. A majority of mothers (46.2%) were aged between 31-40 years, while 38.5% of children were aged 5-6 years.

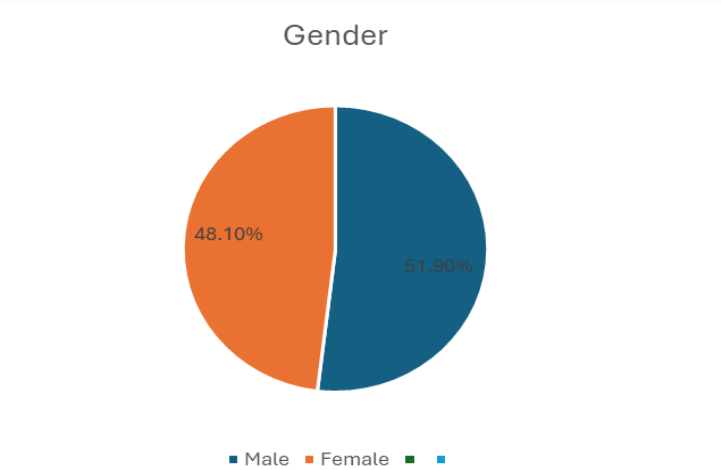

Figure 1: Gender of Child

In Figure 1, the gender distribution of children shows that 51.9% (n=135) are male, while 48.1% (n=125) are female.

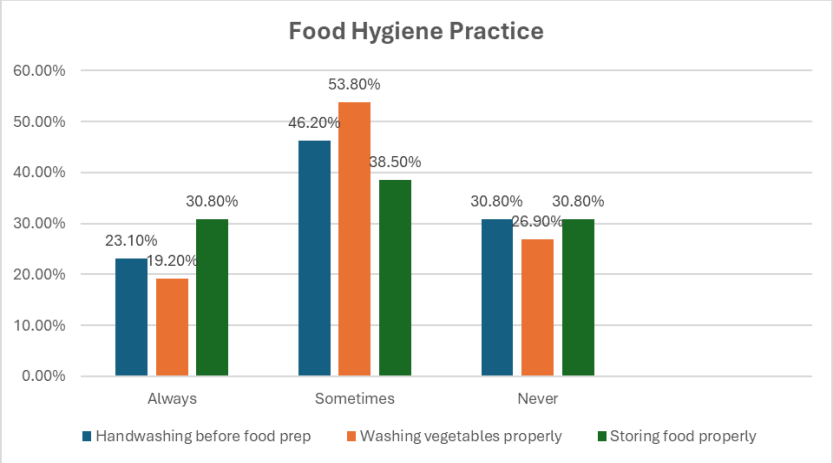

Figure 2: Food Hygiene Practices of Mothers (N=260)

Figure 2 highlights the food hygiene practices of mothers. A significant proportion of mothers reported "sometimes" engaging in handwashing (46.2%), washing vegetables properly (53.8%), and storing food properly (38.5%). Although some mothers practiced hygiene consistently (e.g., 30.8% always stored food properly), many did not follow these practices regularly.

Table 2: Frequency of Diarrheal Episodes in Children in the last 3 months (N=260)

Diarrheal Episodes	Frequency (n)	Percentage (%)
1-2 episodes	50	19.2
3-4 episodes	90	34.6
More than 4 episodes	120	46.2

Table 2 shows the frequency of diarrheal episodes among children in last 3 months. The majority of children (46.2%) experienced more than 4 episodes of diarrhea, while 34.6% had 3-4 episodes, and 19.2% had 1-2 episodes.

Table 3: Correlation Between Food Hygiene Practices and Frequency of Diarrheal Episodes (N=260)

Food Hygiene Practice	Frequency of Diarrheal Episodes (1-2)	Frequency of Diarrheal Episodes (3-4)	Frequency of Diarrheal Episodes (>4)	P-value
Handwashing before food prep				
Always	30 (50.0%)	20 (33.3%)	10 (16.7%)	0.003
Sometimes	10 (16.7%)	40 (66.7%)	70 (56.7%)	
Never	10 (16.7%)	30 (50.0%)	40 (33.3%)	
Washing vegetables properly				
Always	20 (40.0%)	15 (30.0%)	15 (30.0%)	0.012
Sometimes	50 (35.7%)	70 (50.0%)	20 (14.3%)	
Never	20 (28.6%)	30 (42.9%)	20 (28.6%)	
Storing food properly				
Always	25 (31.3%)	30 (37.5%)	25 (31.3%)	0.020
Sometimes	15 (15.0%)	40 (40.0%)	45 (45.0%)	
Never	10 (12.5%)	20 (25.0%)	50 (62.5%)	

Table 3 presents the correlation between food hygiene practices and the frequency of diarrheal episodes. When mothers reported always practicing good hygiene, the incidence of severe diarrheal episodes (more than 4 episodes) was lower (16.7% for handwashing, 30.0% for washing vegetables, and 31.3% for food storage). However, when hygiene practices were reported as "sometimes" or "never," the occurrence of more than 4 episodes increased, highlighting the role of inconsistent hygiene in exacerbating the frequency of diarrhea ($p<0.05$ for all hygiene practices).

Table 4: Association Between Water Source and Frequency of Diarrheal Episodes in Children (N=260)

Water Source	1-2 Episodes (n, %)	3-4 Episodes (n, %)	More than 4 Episodes (n, %)	Total (n, %)	p-value
Well Water	25 (9.6%)	45 (17.3%)	100 (38.5%)	170 (65.4%)	**<0.001**
Boiled Water	15 (5.8%)	30 (11.5%)	25 (9.6%)	70 (26.9%)	
Filtered Water	5 (1.9%)	10 (3.8%)	5 (1.9%)	20 (7.7%)	
Unfiltered Tap Water	5 (1.9%)	5 (1.9%)	10 (3.8%)	20 (7.7%)	
Bottled Water	0 (0%)	0 (0%)	5 (1.9%)	5 (1.9%)	
Total	50 (19.2%)	90 (34.6%)	120 (46.2%)	260 (100%)	

Table 4 presents the relationship between the source of water and the frequency of diarrheal episodes in children. The table shows that a significant proportion of children who consumed well water (38.5%) experienced more than 4 episodes of diarrhea. In contrast, those who drank boiled water had a lower incidence, with only 9.6% reporting more than 4 episodes. A similar trend is observed with filtered water and unfiltered tap water, where the majority of children also experienced more frequent episodes of diarrhea. The p-value of <0.001 indicates a statistically significant association between the source of water and the frequency of diarrheal episodes.

Table 5: Maternal Education and Frequency of Diarrheal Episodes (N=260)

Mother's Education Level	Frequency of Diarrheal Episodes (1-2)	Frequency of Diarrheal Episodes (3-4)	Frequency of Diarrheal Episodes (>4)	P-value
No Formal Education	5 (10.0%)	10 (20.0%)	35 (70.0%)	0.002
Primary Education	10 (13.3%)	30 (40.0%)	35 (46.7%)	
Secondary Education	20 (23.5%)	40 (47.1%)	25 (29.4%)	
Higher Education	15 (30.0%)	10 (20.0%)	10 (50.0%)	

Table 5 shows the association between maternal education level and the frequency of diarrheal episodes. The data suggests that children of mothers with no formal education had the highest incidence of more than 4 episodes (70%), while those with higher education exhibited fewer severe episodes. The association between lower education levels and increased diarrheal episodes is statistically significant (p=0.002), indicating the importance of maternal education in reducing diarrhea risk.

DISCUSSION

This study aimed to explore the impact of food hygiene practices, water sources, and maternal education on the incidence of diarrheal episodes in children of working mothers in rural Bangladesh. The findings underscore the importance of hygiene practices, water quality, and maternal education in mitigating diarrheal risks among children [27-37]. The majority of mothers were aged between 31-40 years (46.2%), and 38.5% of the children were aged 5-6 years. The gender distribution of the children was almost equal, with 51.9% male and 48.1% female, similar to previous studies on rural populations where gender distributions tend to be balanced. Our study demonstrated a significant association between food hygiene practices and the frequency of diarrheal episodes (p<0.05 for all hygiene

practices). The majority of mothers reported that they "sometimes" engaged in essential food hygiene practices. For instance, 46.2% of mothers washed their hands before food preparation "sometimes," and 53.8% washed vegetables "sometimes." However, improper practices like not storing food properly were reported by 30.8% of mothers. The data correlates with previous findings that poor hygiene practices increase the likelihood of gastrointestinal illnesses in children [38-45].

In Table 4, when mothers reported always practicing good hygiene (e.g., always washing hands), the incidence of severe diarrheal episodes (more than 4 episodes) was significantly lower, with only 16.7% for handwashing, 30.0% for washing vegetables, and 31.3% for food storage. However, when these practices were reported as "sometimes" or "never," the occurrence of more than 4 episodes increased substantially (56.7% for handwashing, 50% for vegetable washing, and 45% for food storage). This is consistent with research that suggests poor food hygiene is a major factor in the spread of diarrheal diseases, particularly in low-income settings [46, 47]. The study also revealed a strong correlation between water source and frequency of diarrheal episodes. Table 5 highlights that children consuming well water were at a significantly higher risk of more than 4 episodes of diarrhea (38.5%), compared to those who consumed boiled water (9.6%). The p-value of <0.001 indicates a statistically significant association between water source and the frequency of diarrheal episodes, further validating the role of water quality in the incidence of diarrhea26. This supports findings from other studies indicating that unfiltered water, including well water, is a major contributor to waterborne diseases in rural communities. In contrast, boiled or filtered water is linked to better health outcomes in children. The study also examined the influence of maternal education on the frequency of diarrheal episodes. Table 6 showed that children of mothers with no formal education were most likely to experience more than 4 episodes of diarrhea (70%). In contrast, those with higher education had fewer severe episodes (50%). This association is statistically significant (p=0.002). Previous studies have found that maternal education positively influences children's health outcomes, with more educated mothers being more likely to adopt healthy practices and seek healthcare when needed [48]. While the study provided valuable insights, it is limited by its cross-sectional design, which prevents causal inferences. Additionally, self-reported data on hygiene practices and water sources may have introduced recall bias. Future studies could include longitudinal designs and objective measures of hygiene and water quality26.

CONCLUSION

This study highlights the critical role of food hygiene practices, water quality, and maternal education in the incidence of diarrheal episodes among children in rural Bangladesh. The findings suggest that improving hygiene practices, providing access to safe water, and enhancing maternal education could significantly reduce the risk of diarrheal diseases in rural areas. Interventions focusing on these areas are essential to improving child health and preventing waterborne illnesses in rural populations.

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